Similarly in case of binaural telephones, one corresponding to each shank of the U-tube, $s_0 = 152$, $r_0 = 49{,}500$, the results were, for example,

$r \times 10^{-3}$	14	23	33	43	ohms
s observed	105	65	41	25	fringes
s computed	103	66	41	25	fringes

If the effective voltage is constant and $s = 1$ in the equation, $r' = r_0 \log s_0$, where r' is the resistance needed to reduce the deflection to one fringe. Hence r' is an index of the sensitiveness of telephones, all operating in the given circuit successively. A number of tests so made ranged from $r' = 3 \times 10^3$ for common telephones to $r' = 10^5$ for high resistance telephones.

The meaning of the equation given is not so easily determined, since the acoustic pressure is produced through the intermediation of the telephone mechanism. If we suppose that, within limits, the amplitude a of the air waves produced at the plate is proportional to the amplitude of the current in the telephone, the exponential equation would then belong to the acoustic pressure p, and may be written, $p = p_0 e^{a_0/a}$. This seems to me probable, as it would explain the absence of registry in case of the pinhole resonator, for instance, when the sounding organ pipe is over 5 meters distant; i.e., the rapid decline of the fringe deflection with the distance of the source of sound may thus be quantitatively evaluated.

* Advance note from a report to the Carnegie Institution of Washington, D. C.

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*THE EQUILIBRIUM POSITIONS OF THE VACUUM GRAVITATION NEEDLE IN 1921 AND 1922**

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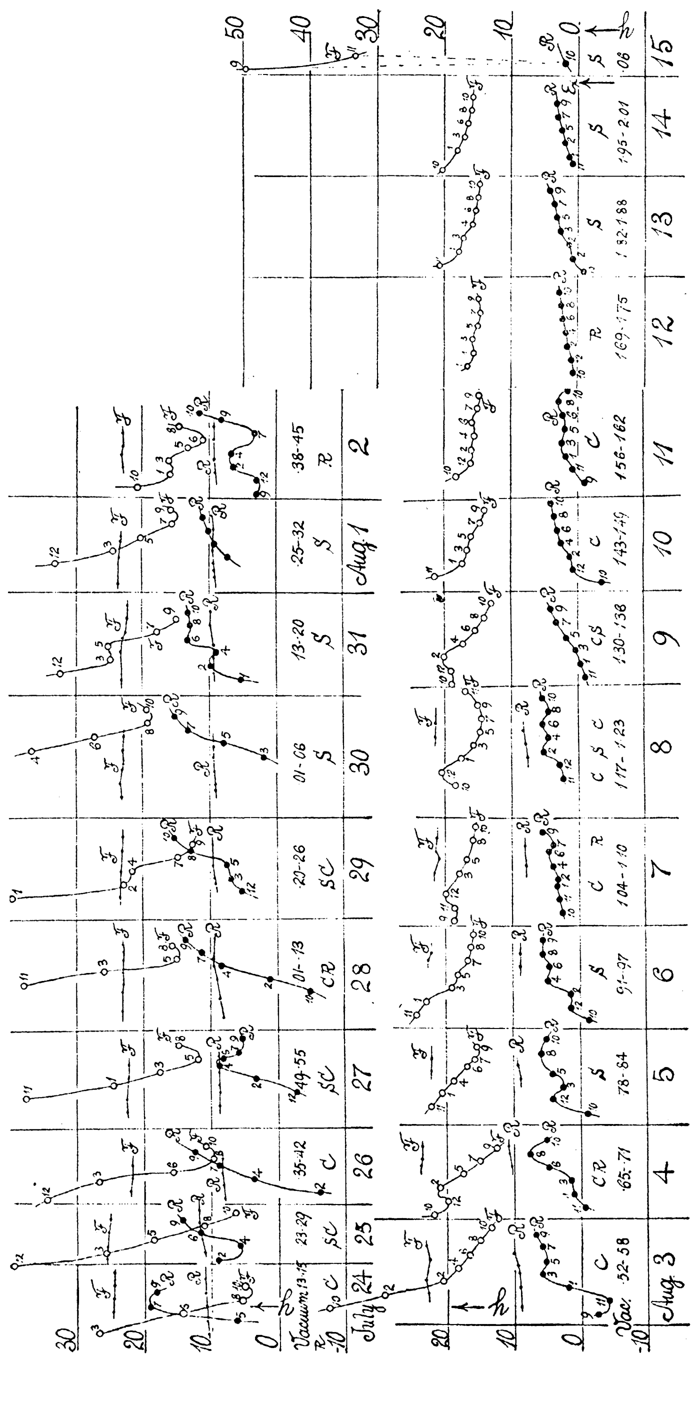
The apparatus used last year was identical with the present one, excepting only the minor appurtenances, added to secure greater convenience in exhaustion. These are without influence. Moreover neither the location of the apparatus nor the mechanism of the weights M had been changed. The method of observation was substantially the same. It is thus very difficult to account for the erratic behavior of the gravitation needle during July and August of this year, as compared with the nearly constant deflections (Δy, y being the telescopic scale reading in centimeters) obtained under like conditions last year. I have, therefore, in the figure, put the static elongations y for the same day in 1921 and



1922 together, successive observations of the position of equilibrium (about one hour apart) being inserted equidistant horizontally. Data for 1922 are distinguished by little circles with the nearest hour number of the observation attached. Data for 1921 are given in points, in corresponding positions, for easy comparison. F denotes that the attracting weight M on the right end of the needle is in front of it. R, that M is to the rear of the needle. Complete sets of observations (i.e. equilibrium curves F and R) are given between about 10 A.M. and 10 P.M. for each year from July 24 to August 8 and to Aug. 15 in 1922. The exhaustion of the case in the morning and at night is shown on each day for 1922 only, as the data were not taken in 1921. In the same place C refers to cloudy, C' to partly cloudy weather, S to sunshine or a clear day and R to rain. It is seen at a glance that the variations of the position of equilibrium y in the lapse of time, are of a different order in 1922, from their approximate constancy in the given scale, in 1921. The contrast is startling with nothing easily apparent to account for it, unless it is traceable to a difference in the respective vacua. For the exhaustions, as a whole, were thought to have been of about the same order of value in both years. In 1922 there was fresh exhaustion on July 24, 28 and 30. Thereafter I left the apparatus with its slight leak (.12 mm. per day), to itself, until August 15. In 1921 there were no intermediate exhaustions and unfortunately the McLeod gauge was not attached to the case.

The figure shows that all observations have a period of one day (24hr). Consequently the variations cannot be contributed by anything within the laboratory, though their enhancement is possible. They must in other words be originally meteorological, and due to solar radiation. Immediately after exhaustion (as on July 28, 30) there are apt to be large deflections, probably showing that the air within the case, though very rare, has nevertheless an appreciable cooling or other effect. For this reason I ceased to make exhaustions after July 30, and the observations, possibly for this contributory reason among others, gradually grew smoother and more normal. Any slight cooling of the inside of the case would tend to exaggerate the day time meteorological effect. If the cooling due to an exhaustion from 1 mm. to .001 mm. of pressure were instantaneous one would estimate that about .01 ca. would be abstracted from the air within the case. This is largely supplied of course by the massive case and the exhaustion is necessarily very gradual. Nevertheless the effect on the needle is always very marked. One cannot observe with the pump running, as the needle persistently clings to the wall of the case.

An inspection of the equilibrium curves in July, 1922, shows that F and R are quite liable to intersect somewhere between 6 and 8 P.M. which means that the radiant forces are in excess (Δy negative) and they may

thereafter considerably overbalance the gravitational pull. This happens when the temperature-time coefficient $d\theta/dt$ is negative. When the latter is positive, gravitation and the radiant forces coöperate. It is seen, moreover, that the higher exhaustions (a few tenths mm. and less), are (like the plenum) favorable to strong radiant forces; whereas in moderate exhaustions (a few millimeters) the radiant forces tend to a minimum, so that the night observations become more and more trustworthy. This may be inferred from the gradual simplification of the F, R curves between Aug. 1 and August 14. In corroboration, the apparatus was again exhausted on Aug. 14 and tested about 12 hours later on the morning of Aug. 15. It is seen that the strong radiant forces have reappeared.

* Advance note from a report to the Carnegie Institution of Washington, D. C.

FURTHER MEASUREMENTS OF STELLAR TEMPERATURES AND PLANETARY RADIATION

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Communicated September 21, 1922

1. *Introductory Statement.*—In a previous communication[1] estimates were given of the temperatures of 16 stars as determined from their spectral energy distribution which was determined by means of a new spectral radiometer, consisting of a series of transmission screens and a vacuum thermocouple.

By means of these screens, which, either singly or in combination, had a uniformly high transmission over a fairly narrow region of the spectrum and terminating abruptly to complete opacity in the rest of the spectrum, it was possible to obtain the radiation intensity in the complete stellar spectrum as transmitted by our atmosphere.

Not being equipped at that time for making radiometric measurements on the Sun, the effective temperature of which is known with some degree of accuracy, and hence could be used as a standard, an estimate of the effective temperature of a star was obtained by two methods, one of which consisted in using a solar type star (α Aurigae, Class G o) as a standard. This seemed permissible in view of the fact that the observed temperature (6000° K) of α Aurigae was found to be in close agreement with that assigned to the Sun.

The object of the present communication is to report a verification of the above-mentioned stellar radiation measurements, by similar measure-